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REMARKS

I. Introduction

In response to the Office Action dated July 15, 2005, please consider the following remarks. Re-examination and re-consideration of the application, as amended, is requested.

II. Allowed Claims

In paragraph [7], claims 12-14 are allowed. The Applicant thanks the Examiner for the indication of allowed subject matter.

III. Allowable Subject Matter

In paragraph [8], the Office Action indicates that the subject matter of claims 8, 23, and 32 would be allowable if written in independent form including all of the limitations of the base claim and any intervening claims. The Applicant acknowledges the Office Action's indication of allowable subject matter, but traverse[s] the rejection of claims 1-7, 9-11, 15-22, 24-31, and 45-52. Should the rejection of these claims be maintained, the Applicant will make suitable amendments to present the allowable claims in independent form.

IV. The Cited References and the Subject Invention

A. The Torkington Reference

U.S. Patent No. 6,198,907, issued March 6, 2001 to Torkington et al. discloses a satellite communications systems using satellites in a zero-drift constellation. The zero-drift constellation (200 FIG. 2) is used to simplify the tracking and hand-off requirements of terrestrial-based user terminals (110 FIG. 1). Each satellite (120 FIG. 1) traces out a common ground track which has a number of southbound segments and an equal number of adjacent northbound segments. This allows user terminals (110) to employ antennas with only one degree of freedom to track satellites (120) in zero-drift constellation (200). User terminals (110) perform hand-offs with satellites (120) that are within a limited field of view with respect to user terminal (110). User terminal (110) tracks a first satellite until a crossover point is reached and then performs a hand-off to a second satellite traveling in the opposite direction along an adjacent segment. User terminal (110) tracks the second satellite until another crossover point is reached and then performs a hand-off to a third satellite traveling in the same direction as the first satellite along an adjacent segment.

B. The Briskman Reference

U.S. Patent No. 6,564,053, issued May 13, 2003 to Briskman et al. disclose efficient high latitude service area satellite mobile broadcasting systems, which include orbital constellations for providing high elevation angle coverage of audio broadcast signals from the constellation's satellites to fixed and mobile receivers within service areas located at geographical latitudes well removed from the equator.

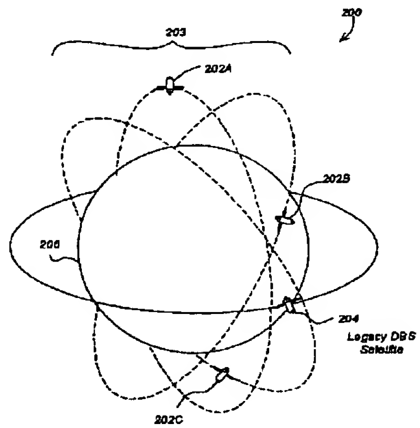
C. The Anderson Reference

U.S. Patent No. 6,778,810, issued August 17, 2004 to Anderson discloses a method and apparatus for mitigating interference from terrestrial broadcasts sharing the same channel with satellite broadcasts using an antenna with posterior sidelobes. An apparatus for simultaneously receiving a first signal from a non-terrestrial source and a second signal from a terrestrial source on the same or overlapping channels using a receive antenna with posteriorly-directed sidelobes is disclosed. The apparatus comprises at least one terrestrial transmitter transmitting information on at least one frequency simultaneously usable by at least one satellite transmitting to a satellite receive antenna having a sensitivity characterizable by a primary sensitive axis directed substantially at satellite. The terrestrial transmitter includes a azimuthal gain characteristic directed substantially away from the Earth's Equator. In an alternative embodiment, the terrestrial transmitter is disposed at a location defining a vector angularly displaced from the primary sensitive axis by an angle of less than 90 degrees. A method of transmitting information is also disclosed. In this method the information is transmitted on at least one frequency simultaneously usable by at least one satellite transmitting to a satellite receive antenna having a sensitivity characterizable by a primary sensitive axis directed substantially at the satellite and a posterior secondary sensitive axis. The method is performed by transmitting the information from a terrestrially-based transmitter to a terrestrial receive antenna in a direction substantially away from the Equator.

D. The Subject Invention

Briefly, Appellant's invention, as substantially recited in independent claims 1, 16, and 24. is described as a system that provides at least near continuous broadcast service to a terrestrial receiver, thus augmenting a legacy satellite constellation in a geostationary orbit. In one embodiment, the system comprises a plurality of satellites (202A-202C) in an inclined, elliptical, geosynchronous orbit.

The plurality of satellites (202A,-202C) arguments at least one legacy satellite (204) in a geostationary orbit. These features are illustrated in FIG. 2 and described in the specification as follows:



> FIG. 2 is a diagram showing one embodiment of a satellite constellation of an enhanced video distribution system 200 using the principles of the present invention. The enhanced video distribution system comprises one or more legacy satellites 108 in a geostationary orbit around the Earth 206, and an augmenting satellite constellation 203 of three or more satellites 202A-202C (hereinafter alternatively referred to as satellite(s) 202) which are in inclined, substantially elliptical, geo-synchronous orbits with objective service at or near the center of CONUS.

In an embodiment substantially recited in independent claims 7, 22, and 31, the satellites 202A-202C provide a portion of the time of the at least near continuous broadcast service to the terrestrial receiver, and the inclined, elliptical, geosynchronous orbit is characterized by an orbital inclination of about 50 degrees and an orbital inclination of about 0.13.

In another embodiment substantially recited in independent claim 12, the system is described by a receiver station (132) for receiving at least near continuous broadcast service from a plurality of satellites (202A-202C). The receiver station (132) (illustrated in FIG. 1) includes an antenna 112 having a sensitivity characteristic (illustrated in FIG. 4) substantially corresponding to the apparent position of each of the satellites (202A-202C), as shown in FIG. 4 and in the discussion appurtenant thereto (page 7, line 13, et seq.).

In another embodiment substantially recited in independent claim 45, the satellite system is described by at least one satellite in a geostationary orbit (204, and illustrated in FIG. 2), a plurality of

satellites, each in an inclined, elliptical geosynchronous orbit (202A-202C), also illustrated in FIG. 2), a receiver station antenna 112 that can communicate with said at least one satellite (204) and at least one of said plurality of satellites (202A-202C) during an active period without tracking, and a gateway (104) having a tracking antenna (106) to track said plurality of satellites (202A-202C). This embodiment is described in FIGs. 1, 2, 4, and 6 and the discussion appurtenant thereto.

Finally, in another embodiment substantially recited in independent claim 50, the satellite system is described by at least one satellite (204) in a geostationary orbit, an augmenting constellation (203) of satellites (202A-202C) in non-geostationary orbit, and a receiver station (132) having a relatively high gain, fixed antenna (112) capable of communication with said at least one satellite (204) in a geostationary orbit and an active one of said augmenting constellation of satellites (203). In this embodiment, a track of an apparent position of each satellite of the augmenting constellation of satellites relative to said antenna when said satellite is in an active period is substantially closed loop.

V. Office Action Prior Art Rejections

In paragraphs (2)-(3), the Office Action rejected claims 1-6, 9, 15-21, 24-30, and 45-49 under 35 U.S.C. § 102(e) as anticipated over Torkington et al., U.S. Patent No. 6,198,907 (Torkington). The Applicant respectfully traverses these rejections.

With Respect to Claims 1, 16, and 24: Claim 1 recites:

> *A system for providing at least near continuous broadcast service to a terrestrial receiver, comprising:*
> *a plurality of satellites, each satellite in an inclined, elliptical, geosynchronous orbit, each satellite providing a portion of time of the at least near continuous broadcast service to the terrestrial receiver,*
> *wherein the plurality of satellites augments at least one legacy satellite in a geostationary orbit.*

According to the Office Action, the plurality of satellites, each in an inclined, elliptical, geosynchronous orbit and providing a portion of the time of the at least near continuous broadcast service to a terrestrial receiver is disclosed as follows:

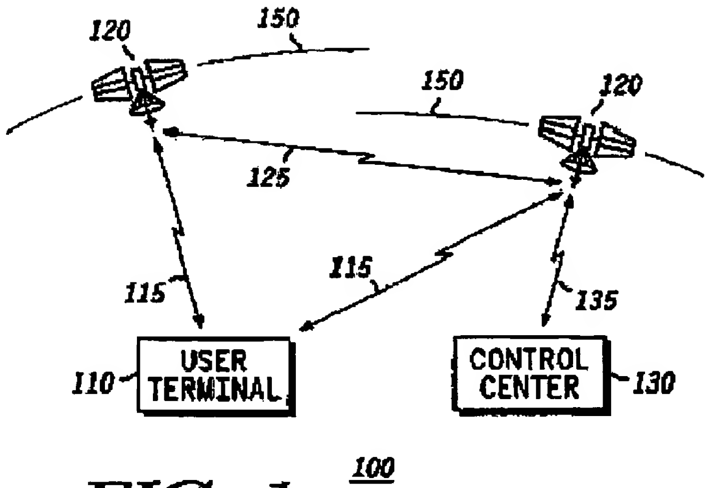
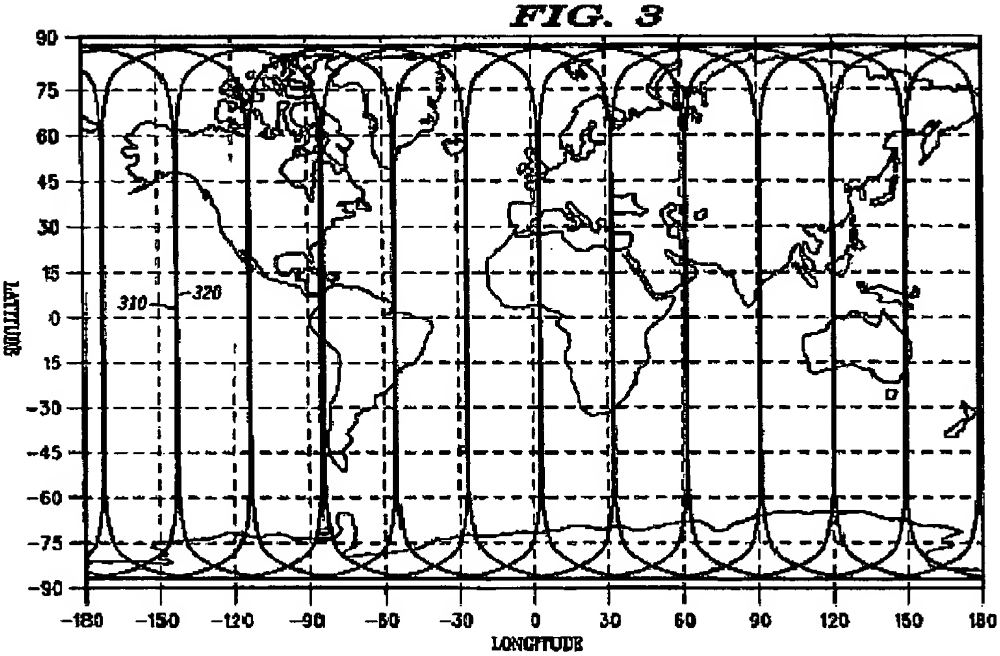


FIG. 1

FIG. 3



As is well known by those skilled in the art, orbital parameters are used to describe a satellite's orbit and a constellation's configuration. The inclination (i) is a constant defining the angle at which the orbital plane intersects the equator. In addition, the Right Ascension of the Ascending Node (RAAN) defines an angle between a non-rotating celestial reference and the line of nodes. The line of nodes is defined by a line formed using the intersection of an orbital plane and the plane of the equator. The line of nodes provides an orbit orientation.

FIG. 1 shows a general view of a satellite communications system in accordance with a preferred embodiment of the invention. Communications system 100 comprises at least one user terminal 110, a plurality of satellites 120, and at least one control center 130. Generally, communications system 100 can be viewed as a network of nodes. All nodes of communications system 100 are or can be in data communication with other nodes of

communications system 100 through communication links (115, 125, and 135). In addition, all nodes of communications system 100 are or can be in data communication with other devices dispersed throughout the world through satellite or terrestrial networks and/or other conventional terrestrial devices coupled to communications system 100 through user terminals 110.

The invention is applicable to satellites that use single or multiple beams pointed towards the earth, and preferably, to satellites that move beams across the surface of the earth along a common ground track. The invention is also applicable to systems where full coverage of the earth is not achieved.

The invention is particularly applicable to satellite communications systems which use low cost user terminals with simple tracking capabilities. The invention provides satellites with synchronized orbits which allow user terminals located at fixed points to have fixed fields of view. Typically, these fields of view require only a single degree of steering freedom and can be defined by a one-dimensional angle such as elevation.

Constellations can be distinguished, for example, by the number of satellites and/or the altitude at which the satellites are positioned. In a zero-drift orbit, a satellite completes a specific number of revolutions in a particular amount of time. In this case, a satellite's altitude is determined by the number of revolutions it makes within a particular amount of time. For example, a satellite's altitude can be restricted to be below the first Van Allen radiation belt. In addition, a satellite's altitude can be determined by the size of a satellite's antenna footprint and the number of satellites in a constellation.

In a preferred embodiment of the invention, satellite communications system 100 comprises a plurality of LEO satellites in a zero-drift constellation. In this case, each satellite is in a resonant zero-drift circular orbit which repeats after a specific number of revolutions of the earth. This means that each satellite in the constellation traces out a substantially repeating ground track after this specific number of revolutions.

In a preferred embodiment, a satellite's position with respect to other satellites 120 within a zero-drift constellation is determined by phasing satellites 120 with respect to each other. In this case, satellite phasing is substantially equal, and this leads to satellites 120 having relatively even spacing within the zero-drift constellation. For example, the phasing between satellites 120 can be determined using a specific number of revolutions and the number of satellites being used in the zero-drift constellation. (col. 2, line 40 through col. 3, line 40)

In a preferred embodiment, processor 630 controls the formation of links 115 (FIG. 1) by, among other things, determining link setup, determining when each satellite will be within the user terminal's FOV, and calculating at least one pointing angle for controllable antenna 650. In addition, processor 630 sends control information to controller 660 so that links can be established at the appropriate times, and it sends control information to controller 660 so that links can be handed-off at the appropriate times. Control signals are transferred between controller 660 and processor 630.

In a preferred embodiment, controllable antenna 650 includes a set of relatively simple tracking elements which are controlled by controller 660. Because satellites in a zero-drift constellation follow a constant ground track, user terminal tracking is only required to have one degree of freedom. For example, a small dish antenna could be used along with a small motor drive that moves the small dish antenna along an arc that the satellites travel along.

In alternate embodiments, controllable antenna 650 includes elements (not shown in FIG. 6) preferably arranged in a two-dimensional array. However, other array configurations are suitable. In these alternate embodiments, controllable antenna 650 can comprise a plurality of array elements which are independently controlled to produce a desired phase relationship to steer one or more antenna beams in any direction over a one-dimensional angular field of view (i.e., one degree of steering freedom). In other alternate embodiments, multi-dimensional fields of view are used. (col. 7, lines 31-59)

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The Applicant respectfully disagrees. Torkington discloses satellites deployed in a low-earth orbit (LEO), not a geosynchronous orbit.

The Office Action also indicates that Torkington discloses at least one legacy satellite in a geostationary orbit as follows:

FIG. 5

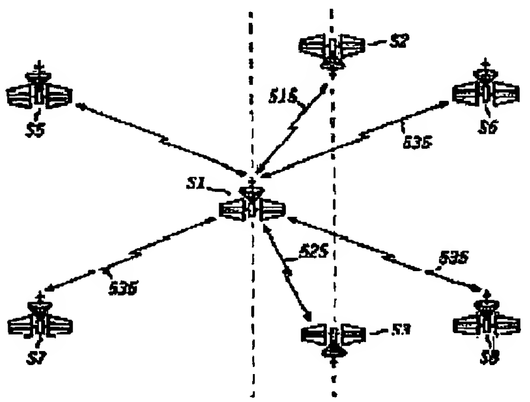


FIG. 9

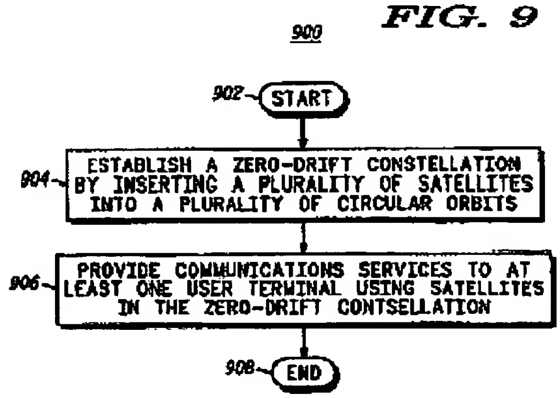


FIG. 9 illustrates a method of establishing a zero-drift constellation to provide communications services to at least one user terminal in accordance with a preferred embodiment of the invention. Procedure 900 begins in step 902.

In step 904, a zero-drift constellation is established by inserting a plurality of satellites into a plurality of circular orbits based on a configuration plan. In some cases, satellites are not immediately inserted into their final orbit, but rather they are inserted into a holding orbit. In one exemplary case, at least one satellite is initially deployed into a holding orbit which is lower than the intended zero-drift orbit. The characteristics of the holding orbit depend on the type of launch vehicle used.

The position of each satellite in a holding orbit is evaluated with respect to its intended zero-drift orbit. The evaluation can be based, for example, on telemetry information received from a satellite or satellites and/or gateways which determines the current orbital parameters for each of the satellites in holding orbits.

In some cases, an insertion profile is determined for each satellite in a holding orbit. The insertion profile includes, among other things, a thruster schedule. A thruster schedule is used to determine which thrusters are to be used and when they are to be used. In other cases, an insertion profile is part of a configuration plan.

In a preferred embodiment, multiple satellites are launched into a single holding orbit. Then, each satellite is inserted into a different zero-drift orbital plane by initiating an insertion profile at different times. The differences between initiation times cause satellites to be positioned in different zero-drift orbits.

Each satellite uses its own insertion profile to position itself in the proper zero-drift orbit. After insertion into the proper position within a zero-drift constellation, the satellites begin to establish crosslinks with other satellites already in place. Constellation capacity is increased as additional satellites are installed in their required orbital positions.

In step 906, a zero-drift constellation is used to provide communications services to at least one user terminal.

> Links are established between satellites in the zero-drift constellation and user terminals. Links are handed-off from one satellite to another as satellites pass through a user terminal's field of view.
>
> In a preferred embodiment, satellites in a zero-drift constellation utilize crosslinks to route data between each other. At least one control center is used to control the zero-drift constellation. Communications services can be provided when a zero-drift constellation is at least partially deployed. The control center, among other things, determines which satellites, which links, and which crosslinks in the zero-drift constellation are available at particular times and at particular locations. (col. 9, line 37 through col. 10, line 21)

The foregoing appears to disclose a method for deploying the LEO satellites, and not from a geostationary orbit (and in any case, it would be prohibitively expensive to do so). Accordingly, the Applicant respectfully disagree and traverse the rejection of claim 1.

Claims 16 and 24 recites features similar to those of claim 1 and is patentable for the same reasons.

With Respect to Claim 9: Claim 9 recites that the antenna of the receiver station has a sensitivity characteristic substantially corresponding to the track of the apparent position of each of the satellites. Torkington does not disclose an antenna having the claimed sensitivity characteristic. instead, Torkington discloses an antenna that has a narrower characteristic, and is steerable in at least one direction to direct it at the appropriate satellite. Accordingly, the Applicant respectfully traverses.

In paragraphs (4)-(5), the Office Action rejected claims 7, 22, and 31 under 35 U.S.C. §103(a) as being unpatentable over Torkington in view of Briskman et al., U.S. Patent No. 6,564,053 (Briskman).

With Respect to Claim 45: Claim 45 recites a receiver antenna that can communicate with at least one satellite of a plurality of satellites in an inclined elliptical geosynchronous orbit during an active period without tracking and a gateway antenna having a tracking antenna to track the plurality of satellites. Torkington, as described above, discloses a user antenna that must track the satellites, and therefore, teaches away from claim 45.

With Respect to Claims 7, 22, and 31: Claim 7 recites:

> *A system for providing at least near continuous broadcast service to a terrestrial receiver, comprising: a plurality of satellites, each satellite in an inclined, elliptical, geosynchronous orbit, each satellite providing a portion of time of the at least near continuous broadcast service to the terrestrial receiver, wherein the orbit is characterized by an orbital inclination approximately equal to 50 degrees and an eccentricity approximately equal to 0.13.*

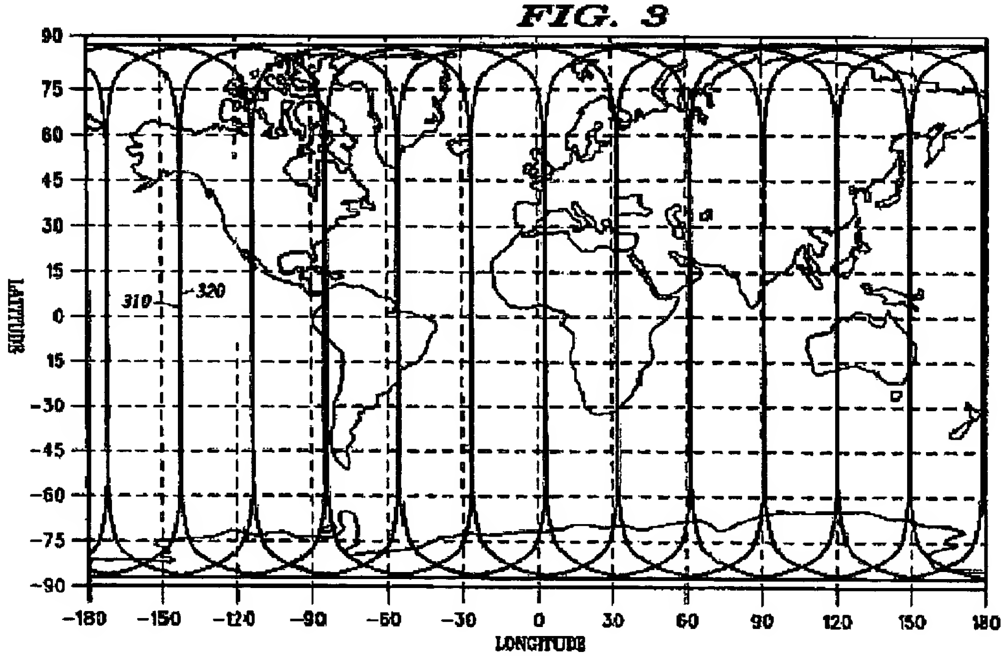
According to the Office Action, Torkington does not disclose "an orbital inclination approximately equal to 50 degrees and eccentricity approximately equal to 0.13", but asserts that Briskman teaches these parameters by teaching a choice of an inclination between 40 degrees and 80 degrees and an

eccentricity range from 0.15 to 0.30. The Office Action also asserts that the motivation to modify the Torkington reference would be to improve the satellite pattern for continuous broadcasting service and optimizing coverage of particular service area in a direct broadcast system.

The Applicant disagrees for several reasons. First, even if there were a teaching to modify Torkington as taught by Briskman, Briskman itself teaches only a very broad range of satellite constellation parameters (40-80 degrees and 0.15-0.30). This general statement is far too broad to suggest the Applicant's invention. Second, Torktingon cannot be modified as suggested in Briskman. Torkington includes user terminals that can track the LEO satellites. One of the advantages of the Torkington reference is that the user terminal antenna need only be steerable in one direction. This is apparent from FIG. 3 and the text below:

> The invention is particularly applicable to satellite communications systems which use low cost user terminals with simple tracking capabilities. The invention provides satellites with synchronized orbits which allow user terminals located at fixed points to have fixed fields of view. Typically, these fields of view require only a single degree of steering freedom and can be defined by a one-dimensional angle such as elevation. (col. 3, lines 4-11)

FIG. 3



Torkington functions by allowing the user terminal to track a satellite as it approaches (e.g. from the top of the tracks shown in FIG. 3 to the bottom), and when a second satellite appears along the same track going in an opposite direction, tracking the second satellite (see Abstract). This requires

that the satellites have an orbital inclination of very nearly 90 degrees (see col. 4, lines 46-58). Larger inclinations will not permit a user antenna with the above characteristics (steerable only in one direction) to switch tracking to the second satellite. Accordingly, Torkington teaches away from the modification suggested in the Office Action. In fact, Torkington would not operate properly if such a modification were made. "If when combined, the references 'would produce a seemingly inoperative device,' then they teach away from their combination." *In re Gurley*, 27 F.3d 551, 553, 31 U.S.P.Q.2d 1130 (Fed. Cir. 1994) (quoting *In re Sponnoble*, 405 F.2d 578, 587, 160 U.S.P.Q. 237, 244 (C.C.P.A. 1969).

Accordingly, the Applicant respectfully traverses the rejection of claim 7.

Claims 22 and 31 recite analogous features and are patentable for the same reasons.

In paragraph (6), the Office Action rejected claims 10, 11, and 50-52 under 35 U.S.C. §103(a) as being unpatentable over Torkington in view of Anderson, U.S. Patent No. 6,778,810 (Anderson).

With Respect to Claim 50: The Applicants believe this rejection was obviated under 35 U.S.C. § 103(a) in the Applicant's response mailed February 22, 2005, because at the time the invention was made, the subject application was made, owned, or subject to an obligation of assignment to the Hughes Electronics Corporation.

VI. Dependent Claims

Dependent claims 2-6, 10-11, 15, 17-21, 25-30, 46-49, and 51-52 incorporate the limitations of their related independent claims, and are therefore patentable on this basis. In addition, these claims recite novel elements even more remote from the cited references. Accordingly, the Applicant respectfully requests that these claims be allowed as well.

VII. Conclusion

In view of the above, it is submitted that this application is now in good order for allowance and such allowance is respectfully solicited. Should the Examiner believe minor matters still remain that can be resolved in a telephone interview, the Examiner is urged to call Applicant's undersigned attorney.

Respectfully submitted,

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